# Hydrological summary

## *for Great Britain*

*February 1998*

## General

In most of Britain a notably wet interlude ending in the third week of January was followed by exceptionally dry conditions through until the end of February. Despite this transformation, overall reservoir stocks remained healthy and have been boosted by early March inflows. February saw river flows decline steeply and, importantly, the very limited rainfall failed to provide any impetus to groundwater recoveries. Water-tables are within the normal range throughout most of the country but remain very depressed in parts of the English lowlands. In these areas, above average rainfall is needed over the next 8-10 weeks to prolong the recharge season and avoid the likelihood of extremely depressed levels by the late summer.

### Rainfall

February was a balmy and unusual mix of seasonally very high temperatures and sunshine hours together with notably low rainfall totals - in all regions apart from western Scotland which was extremely wet. Most rain-bearing low pressure systems followed tracks remote from eastern England as much of Britain fell under the influence of a predominately southerly airflow. Whilst Skye registered more than 200 mm of rainfall in only 6 days around mid-month, large parts of the English lowlands recorded >40 days (from Jan 19th) with accumulated totals of below 8 mm. Despite exceptionally low rainfall in some eastern areas (e.g. Berwickshire), Scotland recorded above average February rainfall but England and Wales, registered its third driest February in the last 33 years (1993 was considerably drier). In most regions where groundwater levels are least healthy, rainfall totals were especially meagre; most of the Anglian and Thames regions recorded <10 mm (dry Februarys are not particularly rare - ten others with totals of 10 mm or less have occurred in the Thames Valley over the last 100 years). Winter (Dec.-Feb.) rainfall has been decidedly episodic in most regions but overall totals are close to the 1961-90 average throughout E&W. 12-month accumulations are also mostly in the 90%-105% range. In water resources terms the long term rainfall deficiencies are most significant in the English lowlands where they are reflected in the very low groundwater levels, for the Thames basin lower 35-month rainfall accumulations this century are restricted to the 1941-44 period.

### River Flow

Following widespread spates in early January, February was a month of protracted recessions, although floodplain inundations were common in western Scotland - around the 10th-16th especially; the Luss Water recorded its highest February flow on the 11th and the Carron established a new monthly runoff maximum. Flows in many spring-fed streams in England continued to benefit from substantial groundwater recharge earlier in the winter. Generally however, flows in February were substantially below average and commonly close to drought minima.

The Rivers Exe, Brue and Yscir registered new minimum runoff totals for February and rivers reporting their second lowest February flows showed a very wide distribution - including the Mimram which recorded its 29th successive month of below average flows. Depressed February runoff characterised most eastern Chalk rivers (where groundwater replenishment through the winter thus far has been limited). Daily flows were exceptionally depressed in southern Britain at month-end but very brisk flow increases in the more responsive western catchments occurred in early March.

### Groundwater

Unusually, soil moisture deficits actually increased in February (but were still modest at month-end) and infiltration was meagre throughout all major aquifers. This is reflected in the steep falls in groundwater levels in some of the more fissured aquifers (e.g. the Carboniferous Limestone). In much of the Chalk (the deeper eastern wells in particular), and in parts of the Permo-Triassic sandstones, water-tables showed a lagged response to the heavy infiltration during the early winter - levels in a substantial minority of boreholes rose modestly during February. However, infiltration in a zone extending north from London to Cambridgeshire has been only around 25% of average over the five months ending in February. Marginal rises in the Chalk at The Holt and Redlands boreholes (in an area where groundwater depletion is most severe), still leave levels very close to the lowest on record. This is also true of the Permo-Triassic sandstones in parts of the Midlands and north Wales also (despite substantial early winter rises). Away from such areas, groundwater levels are generally well within the normal early spring range and overall groundwater resources are healthier than in March 1997. However, in the absence of substantial March/April rainfall, the window of opportunity for further recharge may be a matter of a few weeks in the eastern Chalk; summer recessions may begin at unprecedented levels in some areas.

Institute of Hydrology

British Geological Survey

# *Rainfall . . . Rainfall . . . Rainfall. .*

## Rainfall accumulations and return period estimates

| Area | Rainfall | Feb 1998 | Dec 97-Feb 98 | RP | Sep 97-Feb 98 | RP | Mar 97-Feb 98 | RP | Apr 95-Feb 98 | RP |
|---|---|---|---|---|---|---|---|---|---|---|
| **England & Wales** | **mm** | **18** | **240** | | **456** | | **858** | | **2234** | |
| | **%** | **29** | **98** | **2-5** | **92** | **2-5** | **96** | **2-5** | **85** | **30-45** |
| North West | mm | 60 | 350 | | 610 | | 1072 | | 2788 | |
| | % | 77 | 108 | 2-5 | 89 | 2-5 | 89 | 2-5 | 79 | 150-250 |
| Northumbrian | mm | 25 | 258 | | 414 | | 818 | | 2218 | |
| | % | 43 | 115 | 2-5 | 90 | 2-5 | 96 | 2-5 | 89 | 5-15 |
| Severn Trent | mm | 17 | 189 | | 363 | | 757 | | 1880 | |
| | % | 31 | 94 | 2-5 | 91 | 2-5 | 100 | <2 | 85 | 20-30 |
| Yorkshire | mm | 15 | 220 | | 376 | | 769 | | 1973 | |
| | % | 26 | 100 | <2 | 85 | 2-5 | 94 | 2-5 | 82 | 50-80 |
| Anglian | mm | 7 | 149 | | 276 | | 589 | | 1450 | |
| | % | 19 | 105 | 2-5 | 92 | 2-5 | 99 | 2-5 | 83 | 35-50 |
| Thames | mm | 8 | 158 | | 321 | | 623 | | 1665 | |
| | % | 19 | 88 | 2-5 | 88 | 2-5 | 90 | 2-5 | 83 | 30-45 |
| Southern | mm | 10 | 223 | | 466 | | 781 | | 1969 | |
| | % | 19 | 103 | 2-5 | 104 | 2-5 | 100 | <2 | 87 | 10-20 |
| Wessex | mm | 16 | 243 | | 482 | | 889 | | 2379 | |
| | % | 24 | 99 | 2-5 | 101 | 2-5 | 106 | 2-5 | 97 | 2-5 |
| South West | mm | 21 | 333 | | 692 | | 1192 | | 3195 | |
| | % | 21 | 88 | 2-5 | 97 | 2-5 | 102 | 2-5 | 93 | 2-5 |
| Welsh | mm | 54 | 392 | | 745 | | 1282 | | 3359 | |
| | % | 55 | 100 | <2 | 95 | 2-5 | 98 | 2-5 | 88 | 10-20 |
| **Scotland** | **mm** | **182** | **530** | | **860** | | **1445** | | **3956** | |
| | **%** | **179** | **131** | **10-20** | **101** | **2-5** | **101** | **2-5** | **95** | **2-5** |
| Highland | mm | 297 | 696 | | 1051 | | 1773 | | 4697 | |
| | % | 234 | 136 | 10-20 | 97 | 2-5 | 101 | 2-5 | 92 | 5-15 |
| North East | mm | 43 | 253 | | 505 | | 1028 | | 2929 | |
| | % | 66 | 98 | 2-5 | 94 | 2-5 | 106 | 2-5 | 103 | 2-5 |
| Tay | mm | 104 | 418 | | 739 | | 1226 | | 3479 | |
| | % | 109 | 114 | 2-5 | 101 | 2-5 | 100 | <2 | 97 | 2-5 |
| Forth | mm | 116 | 405 | | 648 | | 1103 | | 3049 | |
| | % | 147 | 132 | 5-15 | 101 | 2-5 | 99 | 2-5 | 94 | 2-5 |
| Tweed | mm | 49 | 310 | | 519 | | 963 | | 2704 | |
| | % | 73 | 119 | 2-5 | 97 | 2-5 | 99 | 2-5 | 96 | 2-5 |
| Solway | mm | 127 | 510 | | 878 | | 1399 | | 3852 | |
| | % | 126 | 126 | 5-10 | 103 | 2-5 | 98 | 2-5 | 93 | 5-10 |
| Clyde | mm | 239 | 652 | | 1060 | | 1642 | | 4522 | |
| | % | 203 | 134 | 10-20 | 102 | 2-5 | 97 | 2-5 | 92 | 5-10 |

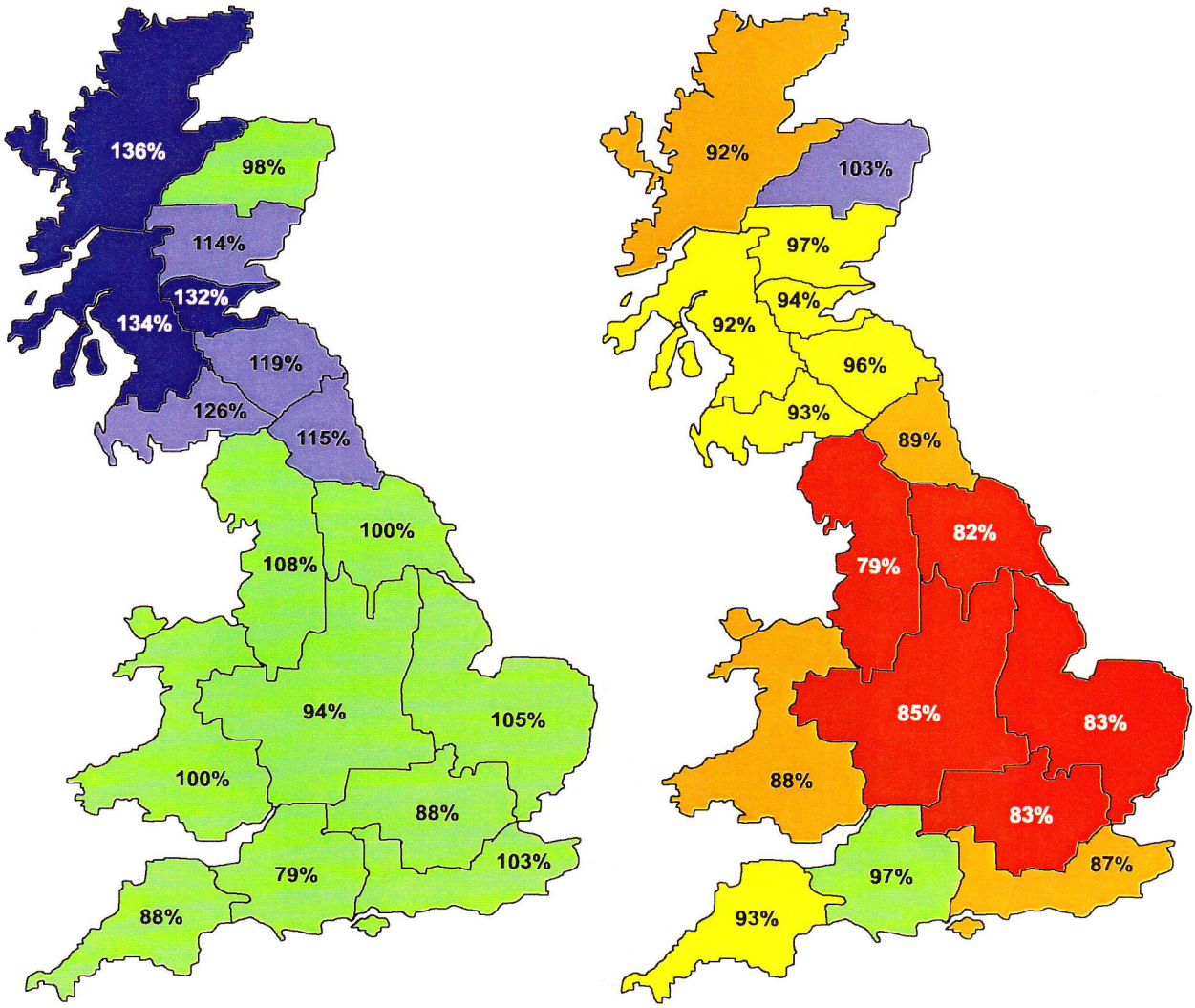
%= % of 1961-90 *RP = Return period*

 Recent monthly rainfall figures for the Scottish regions have ben compiled using data provided by the Scottish Environment Protection Agency. The return period estimates are based on tables provided by the Meteorological Office (see Tabony, R.C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only, (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered). The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past.

# *Rainfall . . . Rainfall . . . Rainfall*

**Key**

| | | | |
|---|---|---|---|
| 00% | Percentage of 1961-90 average | | Normal range |
| | Very wet | | Below average |
| | Substantially above average | | Substantially below average |
| | Above average | | Exceptionally low rainfall |

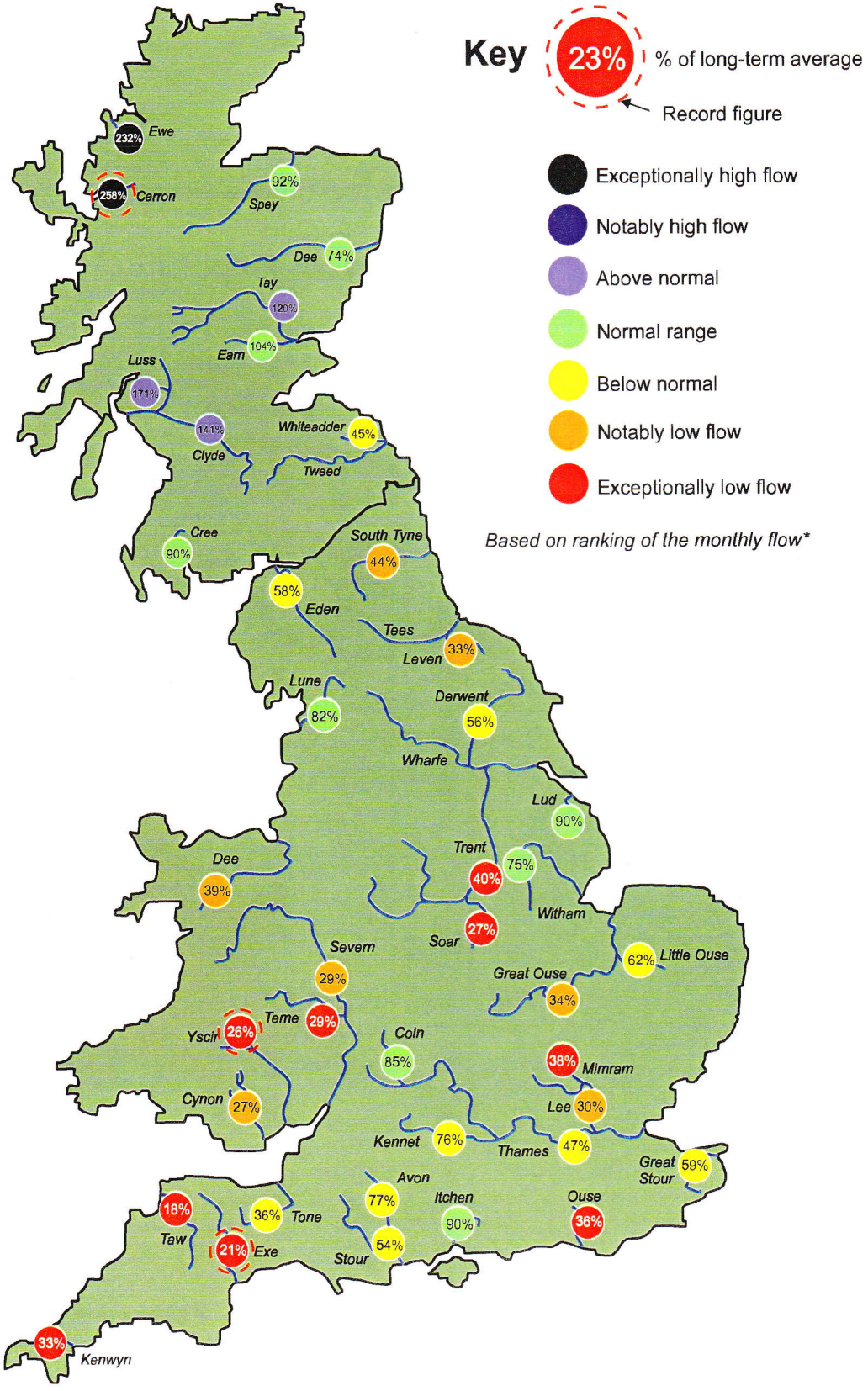



**December 1997 - February 1998** **April 1995 - February 1998**

## Rainfall accumulation maps

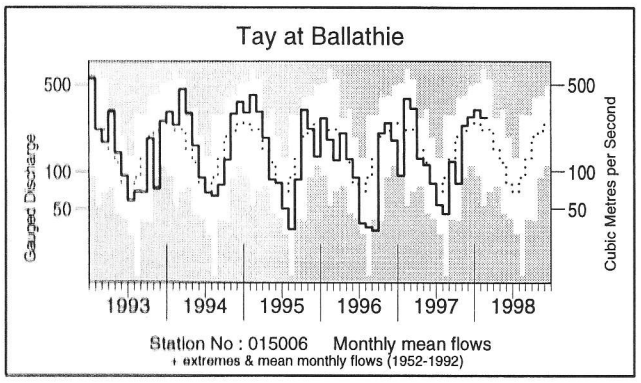
Winter (December - February) rainfall totals show substantial spatial variation but are all well within the normal range. Long term rainfall deficiencies are similar to a year ago - remaining the equivalent of more than 5 months average rainfall over large parts of England - but are of limited water resources significance except in relation to groundwater levels.

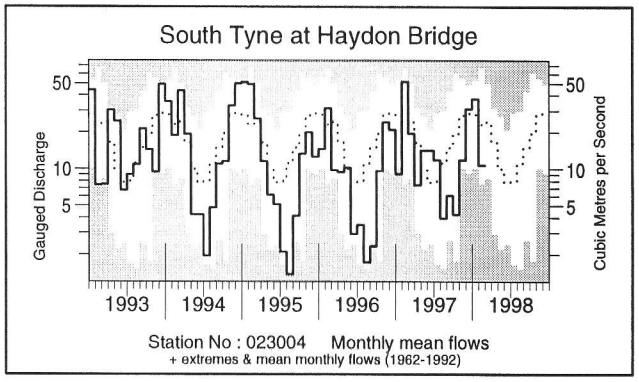
# *River flow . . . River flow . . .*

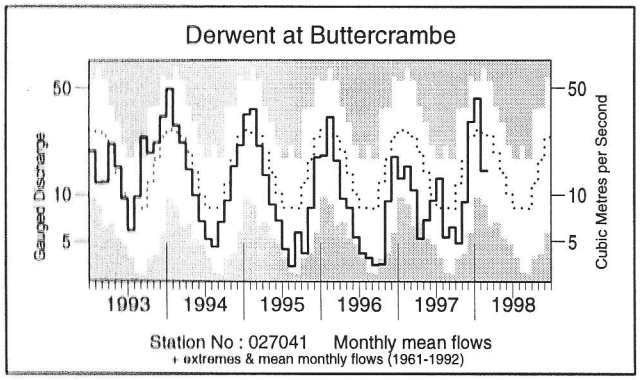


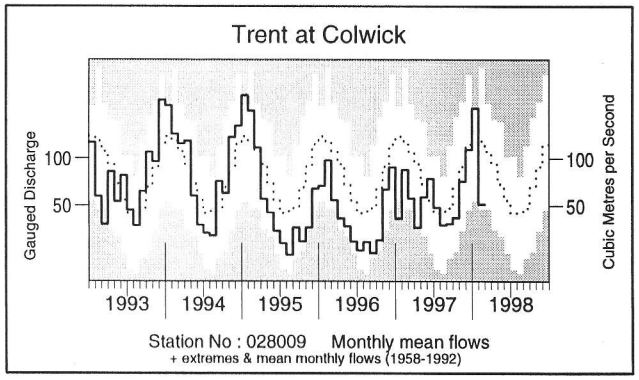

## River flows - February 1998

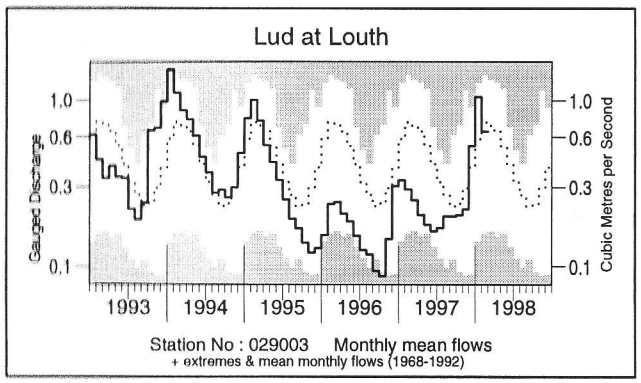
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater.

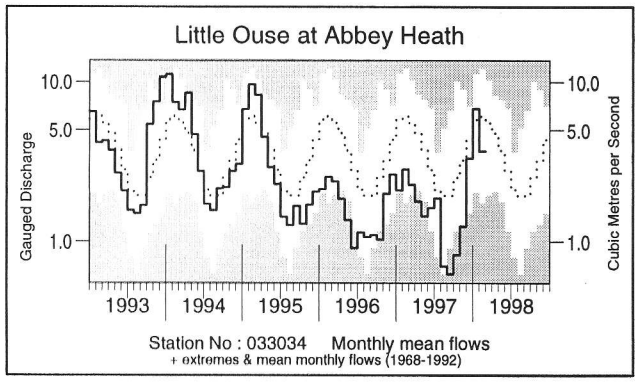


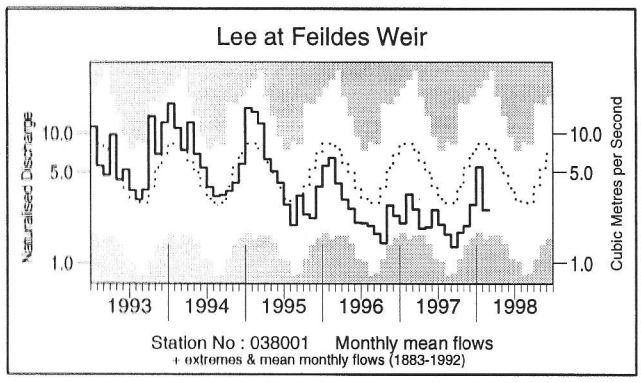



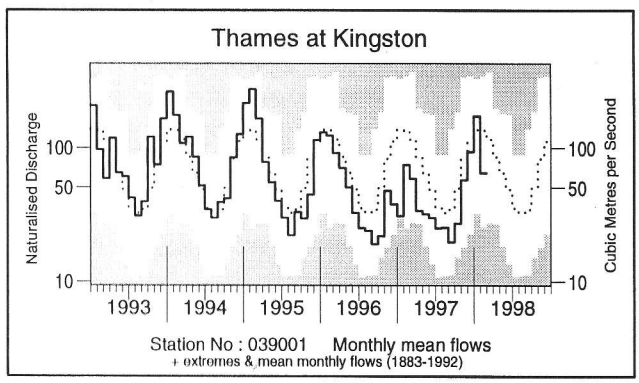



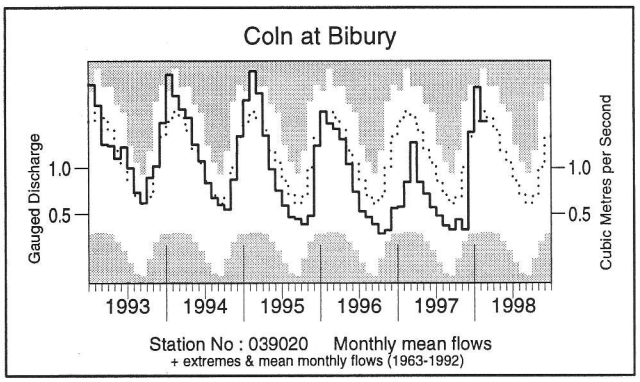



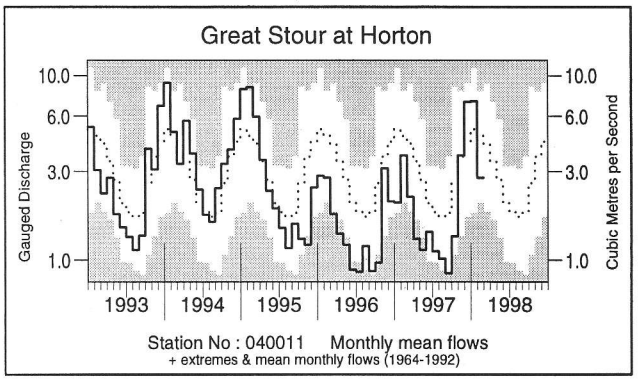



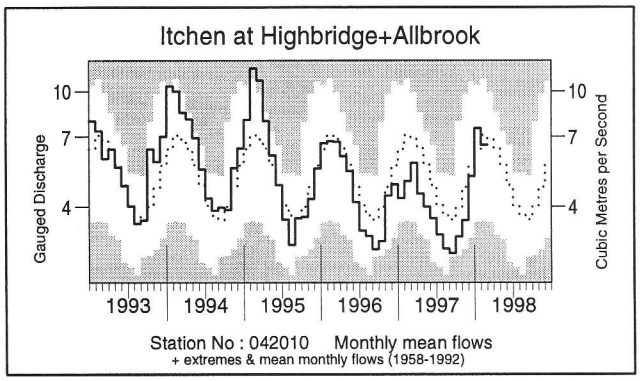

## Monthly river flow hydrographs

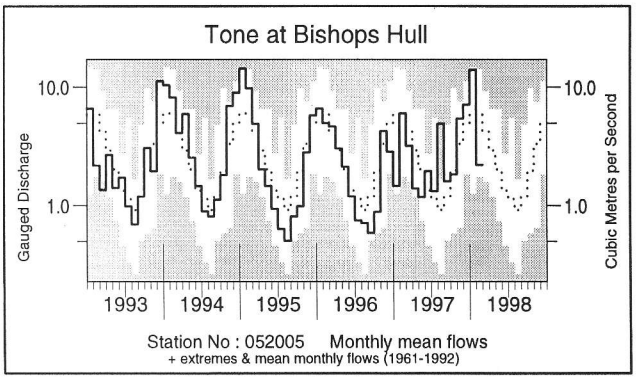
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

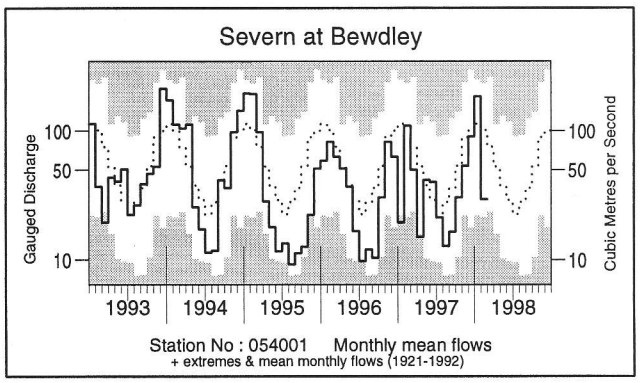
# River flow . . . River flow . . .

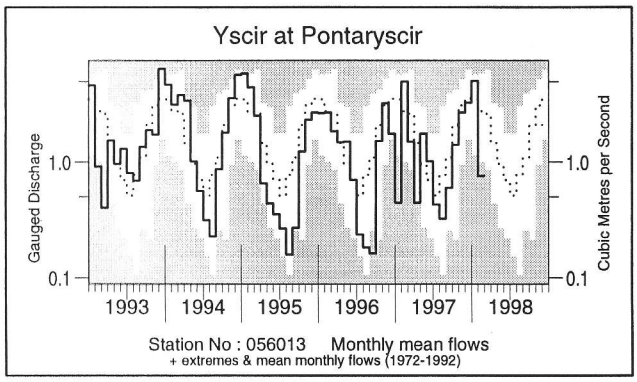


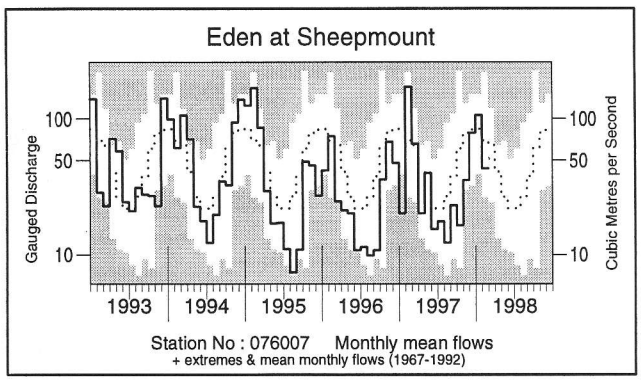



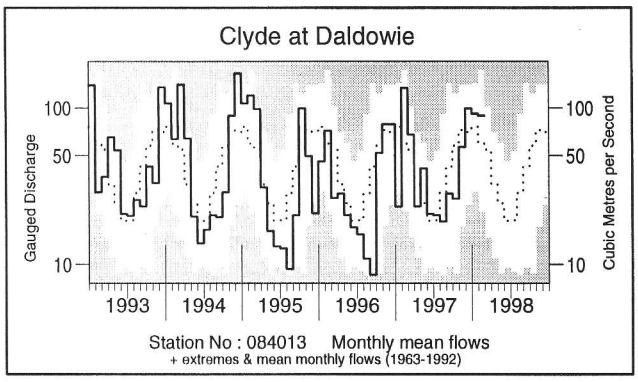



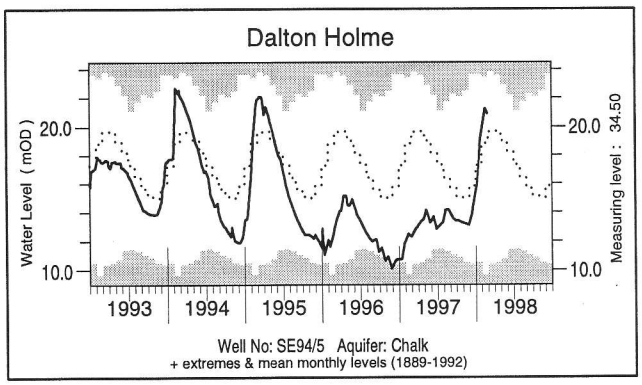



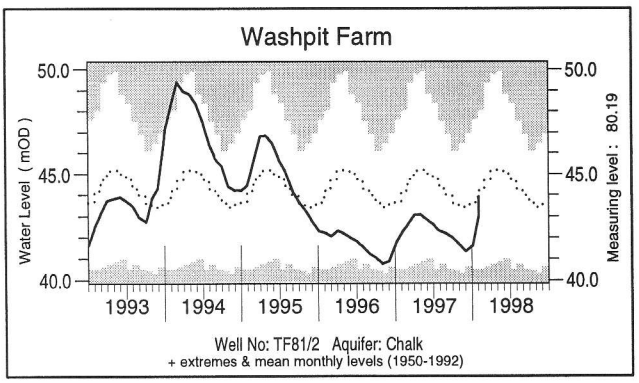

**Notable runoff accumulations September 1997 - February 1998 (a); April 1995 - February 1998 (b)**

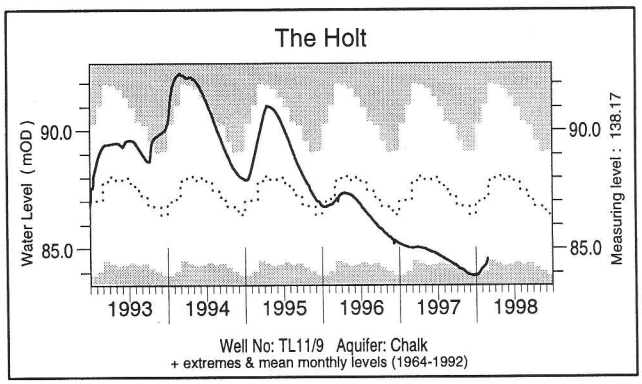
| (a) River | %lta | Rank | (b) River | %lta | Rank | River | %lta | Rank |
|---|---|---|---|---|---|---|---|---|
| Spey | 76 | 4/45 | S.Tyne | 70 | 1/30 | Kennet | 72 | 1/34 |
| S.Tyne | 71 | 3/34 | Wharfe | 65 | 1/40 | Great Stour | 66 | 1/28 |
| Mimram | 48 | 3/45 | Trent | 66 | 1/37 | Severn | 67 | 1/75 |
| **Tone** | **135** | **33/37** | Soar | 59 | 1/24 | Dee (Welsh) | 73 | 1/58 |
| Dee(Welsh) | 83 | 5/29 | Colne | 51 | 1/33 | Eden | 71 | 1/28 |
| Eden | 75 | 5/30 | | | | Carron | 79 | 1/17 |

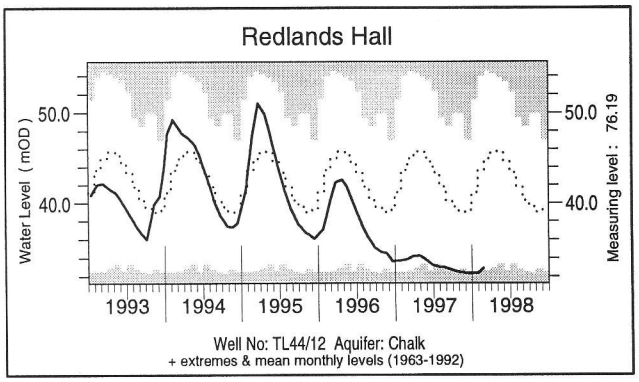
*lta = long term average*
*Rank 1 = lowest on record*

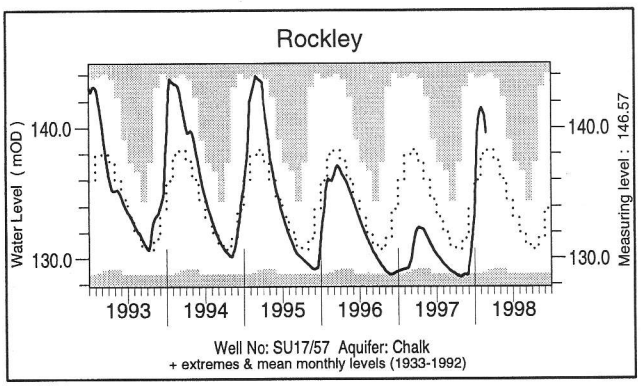
# Groundwater . . . Groundwater

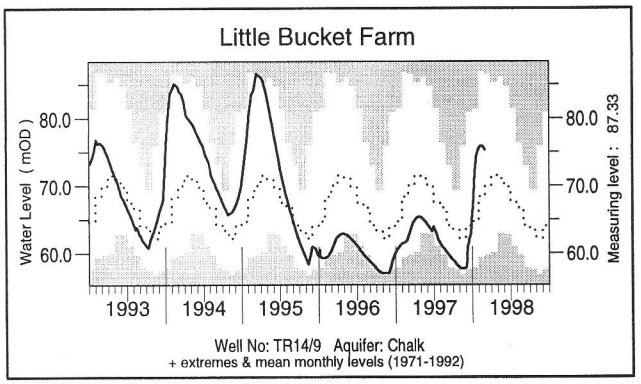


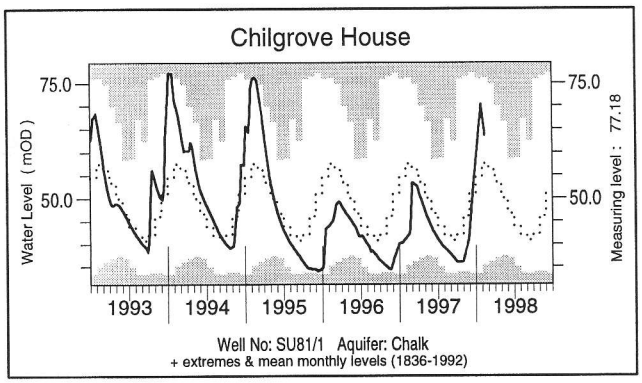



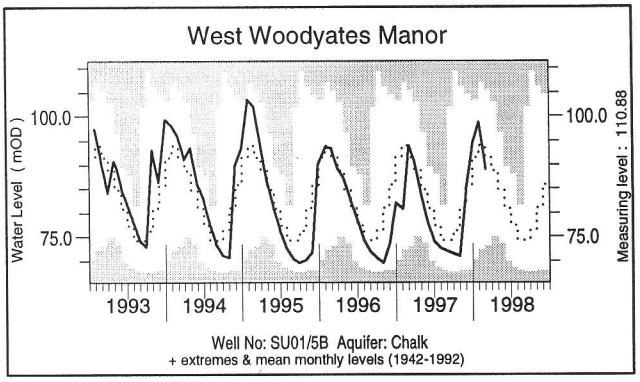



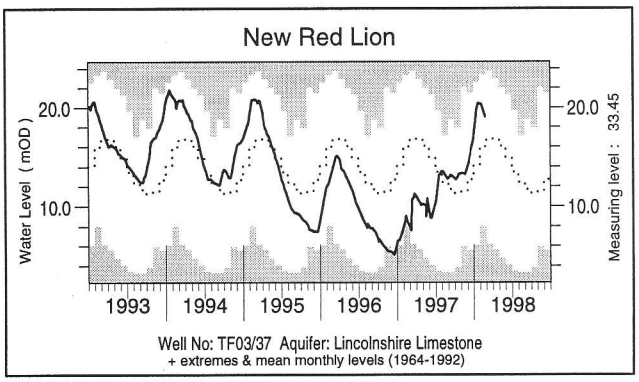



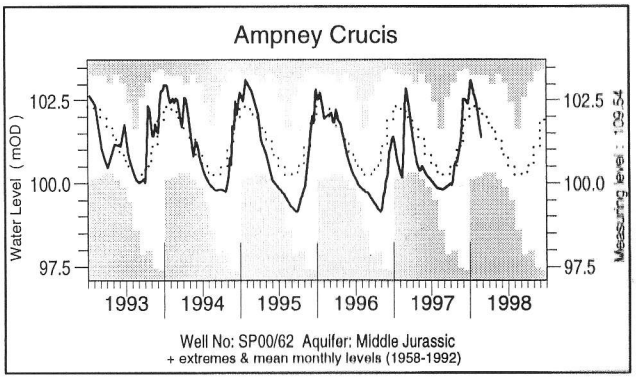



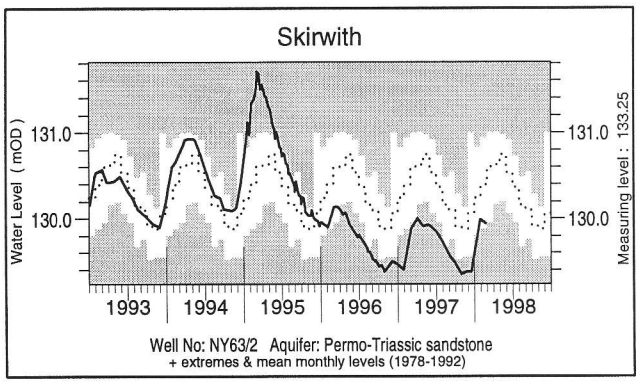

## What is groundwater?

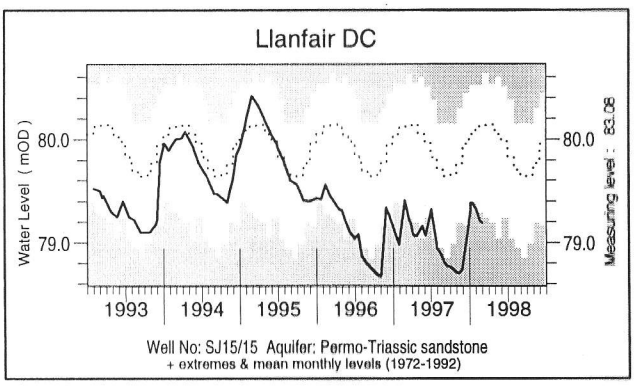
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs, note that most groundwater levels are not measured continuously — the latest recorded levels are listed overleaf.

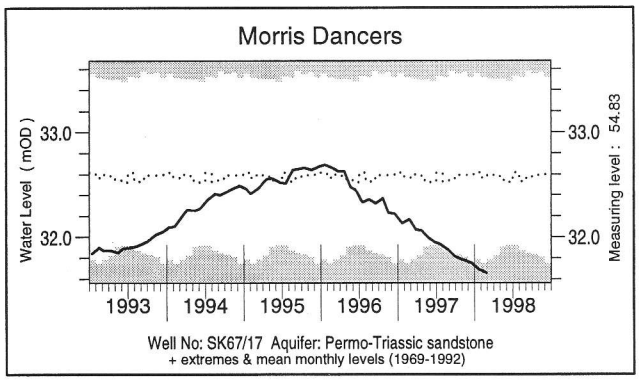
# Groundwater . . . Groundwater

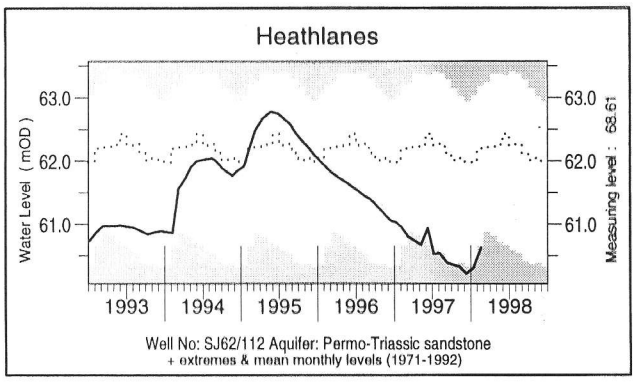


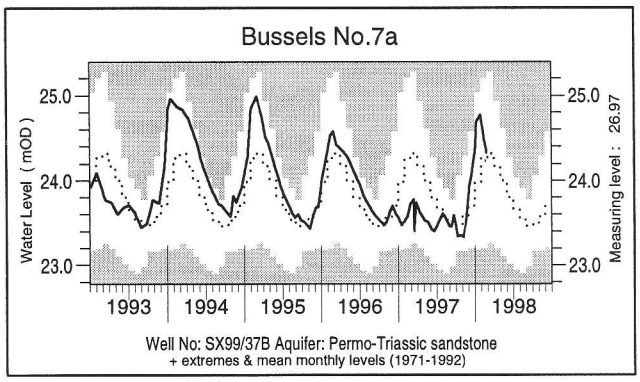



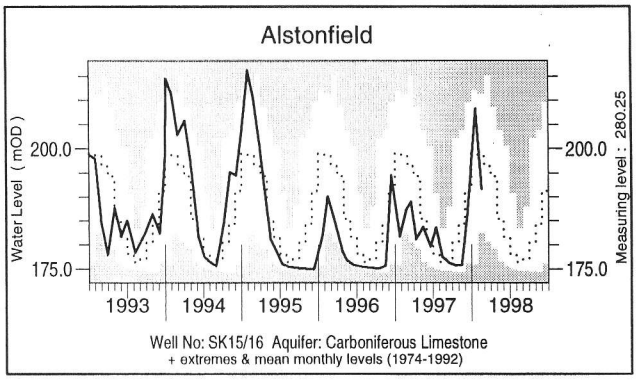




## Groundwater levels February/March 1998

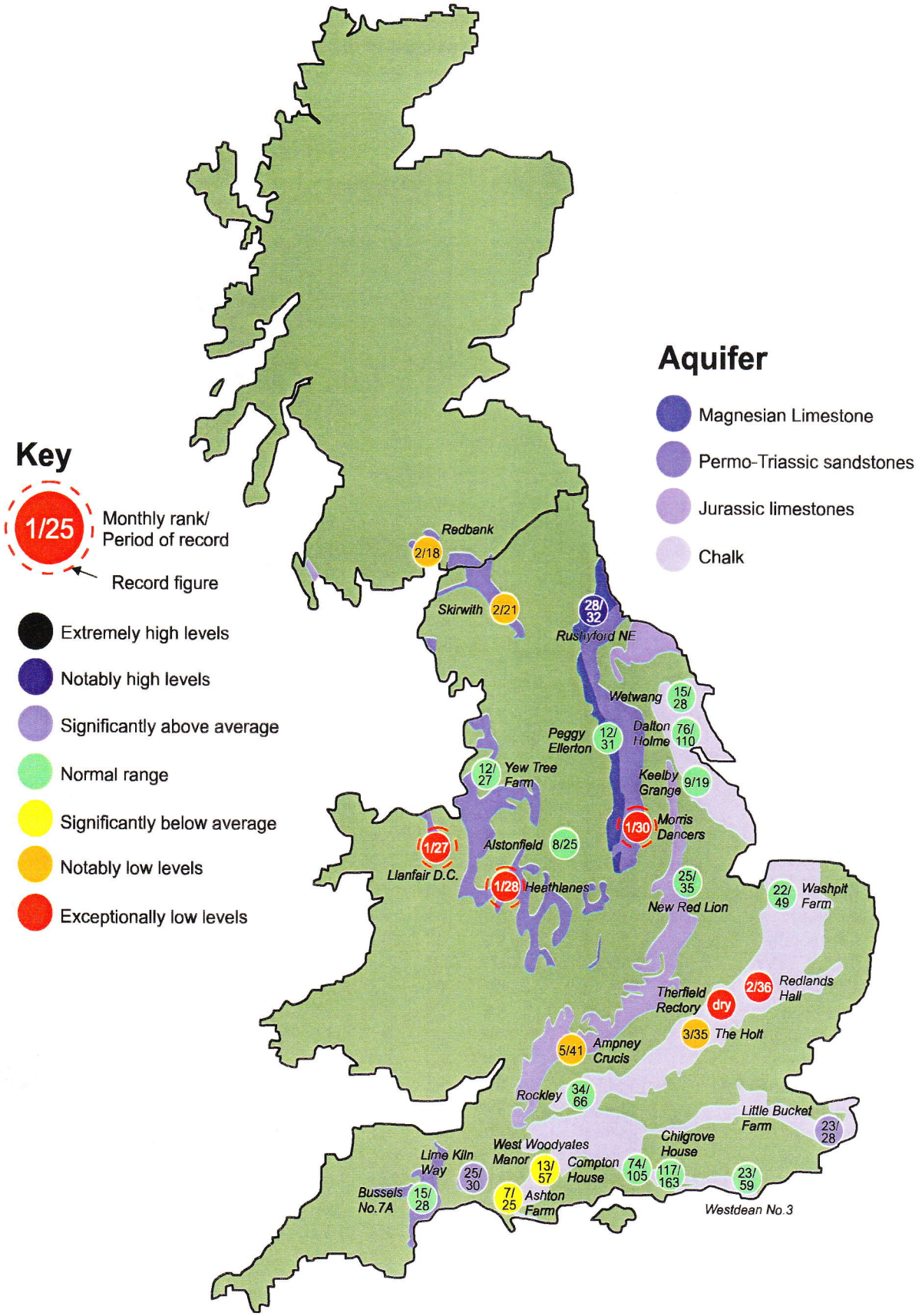
| Borehole | Level | Date | Feb av. |
|---|---|---|---|
| Dalton Holme | 20.88 | 27/02 | 18.67 |
| Washpit Farm | 43.93 | 03/02 | 44.18 |
| The Holt | 84.56 | 23/02 | 87.32 |
| Redlands Hall | 32.84 | 23/02 | 43.05 |
| Ashton Farm | 69.93 | 03/03 | 69.64 |
| Little Bucket | 75.30 | 02/03 | 69.01 |

| Borehole | Level | Date | Feb av. |
|---|---|---|---|
| Chilgrove | 63.56 | 12/02 | 57.41 |
| W Woodyates | 89.02 | 03/03 | 93.05 |
| New Red Lion | 18.99 | 24/02 | 15.92 |
| Ampney Crucis | 101.4 | 23/02 | 102.23 |
| Skirwith | 129.9 | 24/02 | 130.53 |

| Borehole | Level | Date | Feb av. |
|---|---|---|---|
| Llanfair DC | 79.19 | 01/03 | 79.98 |
| Morris Dancers | 31.66 | 25/02 | 32.49 |
| Heathlanes | 60.63 | 17/02 | 61.95 |
| Bussels | 24.33 | 24/02 | 24.28 |
| Alstonfield | 191.6 | 16/02 | 198.89 |

*Levels in metres above Ordnance Datum*

# Groundwater . . . Groundwater

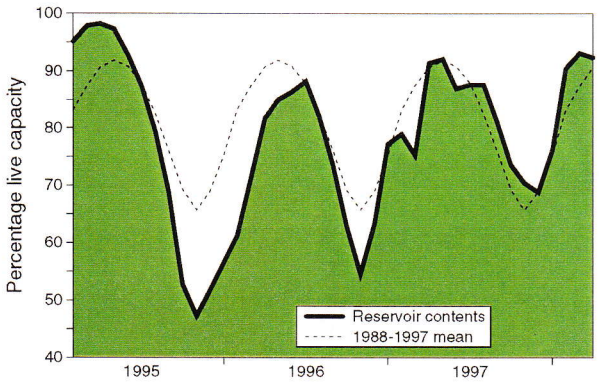



## Groundwater levels - February 1998

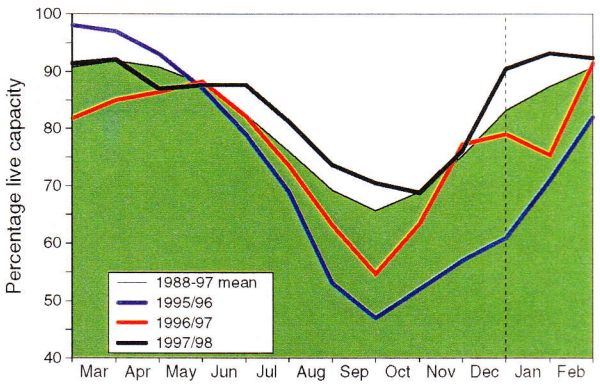
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted where they are considered misleading.

# *Reservoirs . . . Reservoirs . .*

## Guide to the variation in overall reservoir stocks for England and Wales




## Comparison between overall reservoir stocks for England and Wales in recent years




These plots are based on the England and Wales figures listed below.

## Percentage live capacity of selected reservoirs

| Area | Reservoir | Capacity (Ml) | 1997 Oct | Nov | Dec | 1998 Jan | Feb | **Mar** | Min. Mar | Year* of min |
|---|---|---|---|---|---|---|---|---|---|---|
| North West | N Command Zone | • 133375 | 60 | 53 | 64 | 95 | 94 | 92 | 78 | 1996 |
| | Vyrnwy | 55146 | 61 | 59 | 67 | 100 | 93 | 87 | 59 | 1996 |
| Northumbrian | Teesdale | • 87936 | 73 | 65 | 73 | 96 | 97 | 93 | 72 | 1996 |
| | Kielder | (199175) | (82) | (82) | (75) | (95) | (91) | (91) | (81) | 1996 |
| Severn Trent | Clywedog | 44922 | 82 | 81 | 86 | 86 | 89 | 86 | 77 | 1996 |
| | Derwent Valley | • 39525 | 72 | 73 | 79 | 100 | 100 | 90 | 46 | 1996 |
| Yorkshire | Washburn | • 22035 | 72 | 60 | 73 | 98 | 98 | 95 | 53 | 1996 |
| | Bradford supply | • | 41407 | 76 | 72 | 85 | 99 | 98 | 96 | 53 |
| 1996 | | | | | | | | | | |
| Anglian | Grafham | 58707 | 46 | 44 | 47 | 57 | 67 | 75 | 72 | 1997 |
| | Rutland | 130061 | 72 | 71 | 75 | 88 | 96 | 96 | 71 | 1992 |
| Thames | London | • 206399 | 53 | 51 | 68 | 72 | 93 | 97 | 83 | 1988 |
| | Farmoor | • 13843 | 96 | 97 | 92 | 96 | 94 | 97 | 64 | 1991 |
| Southern | Bewl | 28170 | 58 | 56 | 76 | 98 | 100 | 99 | 50 | 1989 |
| | Ardingly | 4685 | 68 | 68 | 100 | 100 | 100 | 100 | 89 | 1992 |
| Wessex | Clatworthy | 5364 | 85 | 85 | 100 | 100 | 92 | 86 | 82 | 1992 |
| | Bristol WW | • (38666) | (67) | (62) | (71) | (97) | (97) | (94) | (65) | 1992 |
| South West | Colliford | 28540 | 43 | 44 | 53 | 62 | 68 | 68 | 57 | 1997 |
| | Roadford | 34500 | 56 | 56 | 65 | 78 | 84 | 84 | 35 | 1996 |
| | Wimbleball | 21320 | 79 | 80 | 91 | 100 | 100 | 97 | 72 | 1996 |
| | Stithians | 5205 | 70 | 68 | 84 | 100 | 100 | 96 | 45 | 1992 |
| Welsh | Celyn and Brenig | • 131155 | 83 | 82 | 86 | 99 | 97 | 98 | 69 | 1996 |
| | Brianne | 62140 | 94 | 97 | 100 | 100 | 94 | 94 | 94 | **1998** |
| | Big Five | • 69762 | 68 | 69 | 87 | 98 | 96 | 91 | 85 | 1988 |
| | Elan Valley | • 99106 | 87 | 92 | 100 | 100 | 97 | 93 | 88 | 1993 |
| East of | Edinburgh/Mid Lothian | • 97639 | 66 | 62 | 67 | 74 | 80 | 79 | 79 | **1998** |
| Scotland | East Lothian | • 10206 | 71 | 62 | 63 | 100 | 100 | 99 | 91 | 1990 |
| West of | Loch Katrine | • 111363 | 72 | 76 | 86 | 97 | 88 | 95 | 95 | **1998** |
| Scotland | Daer | 22412 | 73 | 70 | 87 | 100 | 98 | 100 | 100 | |
| | Loch Thom | • 11840 | 69 | 74 | 82 | 93 | 93 | 100 | 98 | 1994 |

( ) figures in parentheses relate to gross storage • denotes reservoir groups * last occurrence

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each area; this can be particularly important during droughts. The minimum storage figures relate to the 1988-1997 period only. In some gravity-fed reservoirs (eg. Clywedog) stocks are kept below capacity during the winter to provide scope for flood alleviation.

# Location map . . . Location map

# Where the information comes from

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by the Institute of Hydrology (IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and the Office of Water Services (OFWAT).

## River flow and groundwater levels

The National River Flow Archive (maintained by IH) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

## Reservoirs

Reservoir level information is provided by the Water Service Companies, the EA and, in Scotland, the West of Scotland and East of Scotland Water Authorities.

## Rainfall

Most rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data are presented for the regional divisions of the precursor organisations of the EA and SEPA. The recent rainfall estimates for the Scottish regions are derived by IH in collaboration with the SEPA regions. In England and Wales the recent rainfall figures derive from MORECS. MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain. The provisional regional rainfall figures are regularly updated using figures derived from a much denser rainguage network. Further details of Met. Office services can be obtained from:

The Meteorological Office
Sutton House
London Road
Bracknell
RG12 2SY.
Tel. 01344 856858; 01344 854024.

The cooperation of all data suppliers is gratefully acknowledged.

# Subscription

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